PPARGC1A (PPARG coactivator 1 alpha)

Summary of PPARGC1A

PGC-1a is one of the most important factors in controlling mitochondrial health. It's also important for circadian rhythms, energy metabolism, fat metabolism, weight loss, blood pressure, cholesterol homoeostasis and indirectly can help detoxing and drug metabolism. PGC-1a protects against neurodegenerative diseases, decreases inflammation (R) and insulin resistance.

It's better to have this gene increased most of the time.

Recommended name:
Peroxisome proliferator-activated receptor gamma coactivator 1-alpha

Alternative name(s):
PGC-1-alpha
PPAR-gamma coactivator 1-alpha
PPARGC-1-alpha
Ligand effect modulator 6

The Function of PPARGC1A

Transcriptional coactivator for steroid receptors and nuclear receptors. Greatly increases the transcriptional activity of PPARG and thyroid hormone receptor on the uncoupling protein promoter. Can regulate key mitochondrial genes that contribute to the program of adaptive thermogenesis. Plays an essential role in metabolic reprogramming in response to dietary availability through coordination of the expression of a wide array of genes involved in glucose and fatty acid metabolism. Induces the expression of PERM1 in the skeletal muscle in an ESRRA-dependent manner. Also involved in the integration of the circadian rhythms and energy metabolism. Required for oscillatory expression of clock genes, such as ARNTL/BMAL1 and NR1D1, through the coactivation of RORA and RORC, and metabolic genes, such as PDK4 and PEPCK.

PGC-1a is one of the most important factors in controlling mitochondrial health. PGC-1 makes new mitochondria and improves its function. PGC-1 increases energy metabolism and weight loss. This protein may be also involved in controlling blood pressure, regulating cellular cholesterol homoeostasis, and the development of obesity. PGC-1a protects against neurodegenerative diseases. PGC-1 decreases inflammation (R) and insulin resistance. PGC-1a increases fatty acid burning by increasing the carnitine genes (CPT1A (R)).

PGC-1a increase Nrf2 (R), which is important for detoxing. PGC-1a increases PXR (R), which plays an integral role in drug/toxin metabolism by regulating the expression of drug metabolizing enzymes and transporters.

PGC-1 alpha stimulates the expression of clock genes, notably Bmal1 and Rev-erb alpha (R). Mice lacking PGC-1 alpha show abnormal circadian rhythms, body temperature, and metabolic rate (R).

This gene interacts with these diseases:

Disease
Myocardial infarction
Fatty Liver
Insulin resistance
Hyperglycemia
Diabetes Mellitus, Experimental
Heart Diseases
Heart failure
Peripheral neuropathy
Non-alcoholic fatty liver disease

Fetal Growth Retardation
Renal Insufficiency
Obesity
Metabolic Syndrome X
Colitis
Sepsis
Amyotrophic lateral sclerosis
Diabetic retinopathy
Hyperthyroidism
Amblyopia
Nephrotic syndrome
Huntington Disease

The following transcription factors affect gene expression (R):

- FOXO1
- FOXO1a
- PPAR-alpha
- PPAR-gamma1
- PPAR-gamma2
- MyoD
- deltaCREB
- CREB
- aMEF-2
- MEF-2A

Tissue specificity:

Heart, skeletal muscle, liver and kidney. Expressed at lower levels in brain and pancreas and at very low levels in the intestine and white adipose tissue. In skeletal muscle, levels were lower in obese than in lean subjects and fasting induced a 2-fold increase in levels in the skeletal muscle in obese subjects.

Gene Pathways:

- Adipocytokine signaling pathway
- Mus musculus biological processes
- Insulin signaling pathway
- Circadian Clock
- Huntington's disease
- Organelle biogenesis and maintenance
- Developmental Biology

Induction:

Transcription is repressed by ZNF746 which binds to 'insulin response sequences' its promoter.

Molecular Function:

- Androgen Receptor Binding
- Chromatin Dna Binding
- Dna Binding
- Ligand-Dependent Nuclear Receptor Binding
- Ligand-Dependent Nuclear Receptor Transcription Coactivator Activity
- Nucleotide Binding
- Promoter-Specific Chromatin Binding
- Rna Binding
- Rna Polymerase Ii Transcription Cofactor Activity
- Sequence-Specific Dna Binding
- Transcription Coactivator Activity
- Transcription Factor Binding

- Ubiquitin Protein Ligase Binding

Biological Processes:

- Adaptive Thermogenesis
- Adipose Tissue Development
- Aging
- Androgen Metabolic Process
- Androgen Receptor Signaling Pathway
- Brown Fat Cell Differentiation
- Cellular Glucose Homeostasis
- Cellular Respiration
- Cellular Response To Caffeine
- Cellular Response To Estradiol Stimulus
- Cellular Response To Follicle-Stimulating Hormone Stimulus
- Cellular Response To Fructose Stimulus
- Cellular Response To Glucose Stimulus
- Cellular Response To Hypoxia
- Cellular Response To Interleukin-6
- Cellular Response To Ionomycin
- Cellular Response To Lipopolysaccharide
- Cellular Response To Nitrite
- Cellular Response To Oxidative Stress
- Cellular Response To Potassium Ion
- Cellular Response To Resveratrol
- Cellular Response To Thyroid Hormone Stimulus
- Cellular Response To Transforming Growth Factor Beta Stimulus
- Cellular Response To Tumor Necrosis Factor
- Cerebellum Development
- Circadian Regulation Of Gene Expression
- Circadian Rhythm
- Digestion
- Fatty Acid Oxidation
- Flavone Metabolic Process
- Forebrain Development
- Galactose Metabolic Process

- Gluconeogenesis
- Mitochondrion Organization
- Mitophagy
- Mrna Processing
- Negative Regulation Of Glycolytic Process
- Negative Regulation Of Mitochondrial Fission
- Negative Regulation Of Neuron Apoptotic Process
- Negative Regulation Of Neuron Death
- Negative Regulation Of Protein Phosphorylation
- Negative Regulation Of Receptor Activity
- Negative Regulation Of Smooth Muscle Cell Migration
- Negative Regulation Of Smooth Muscle Cell Proliferation
- Positive Regulation Of Atp Biosynthetic Process
- Positive Regulation Of Cellular Respiration
- Positive Regulation Of Energy Homeostasis
- Positive Regulation Of Fatty Acid Oxidation
- Positive Regulation Of Glomerular Visceral Epithelial Cell Apoptotic Process
- Positive Regulation Of Gluconeogenesis
- Positive Regulation Of Histone Acetylation
- Positive Regulation Of Mitochondrial Dna Metabolic Process
- Positive Regulation Of Mitochondrion Organization
- Positive Regulation Of Muscle Tissue Development
- Positive Regulation Of Progesterone Biosynthetic Process
- Positive Regulation Of Sequence-Specific Dna Binding Transcription Factor Activity
- Positive Regulation Of Smooth Muscle Cell Proliferation
- Positive Regulation Of Transcription, Dna-Templated
- Positive Regulation Of Transcription From Rna Polymerase Ii Promoter
- Protein Complex Assembly
- Protein Stabilization
- Regulation Of Circadian Rhythm
- Regulation Of N-Methyl-D-Aspartate Selective Glutamate Receptor Activity
- Regulation Of Transcription, Dna-Templated
- Respiratory Electron Transport Chain
- Response To Cold
- Response To Dietary Excess

- Response To Drug
- Response To Electrical Stimulus Involved In Regulation Of Muscle Adaptation
- Response To Epinephrine
- Response To Ischemia
- Response To Leucine
- Response To Metformin
- Response To Methionine
- Response To Muscle Activity
- Response To Norepinephrine
- Response To Reactive Oxygen Species
- Response To Starvation
- Rna Splicing
- Skeletal Muscle Atrophy
- Temperature Homeostasis
- Transcription Initiation From Rna Polymerase Ii Promoter